The Late-Stage Diagnosis of Colorectal Cancer: Demographic and Socioeconomic Factors

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ABSTRACT

Objectives. This study described factors related to colorectal cancer stage at diagnosis.

Methods. Logistic regression analyses were used on data from the New York State Tumor Registry and US Census area–level social class indicators.

Results. After the effects of other predictors were controlled for, the odds of late-stage cancer increased as age decreased; women and African Americans were significantly more likely to have late stage than men and Whites; and individuals living in areas of low socioeconomic status (SES) were significantly more likely to be diagnosed at late stage than those living in higher SES areas. Stratified analyses showed that living in a low SES area was the most important determinant of stage for all age, race, gender, and source-of-care groups.

Conclusions. While all populations would benefit from the systematic use of screening, socioeconomically disadvantaged groups may also benefit from targeted screening. (*Am J Public Health.* 1996;86:1794–1797)

Introduction

For several cancer sites, age,[1–3] race,[3,4–9] socioeconomic status (SES),[5,9–13] and insurance status[14] have been noted to be related to stage at diagnosis. Stage data are often readily available and correlate with survival. To date, few studies have examined predictors of colorectal cancer stage.[10,15] This paper presents findings on the effects of age, gender, race, ethnicity, type of health care setting, and area socioeconomic status on colorectal cancer stage. We attempt to delineate the pathways leading to having late-stage disease among persons diagnosed with colorectal cancer.

Methods

The sample consisted of 28 872 cases of colorectal cancer among New York City residents reported to the New York State Department of Health Registry between 1980 and 1985 (reporting was 95% complete). The percentage of late-stage disease was calculated through the use of cases with known stage as the denominator; stage was categorized as *early* (in situ or localized) and *late* (regional or distant). Data on Hispanic ethnicity were missing for almost one half of the cases. Since ethnicity and birthplace were highly correlated for cases with nonmissing data, missing cases were recoded as Hispanic on the basis of country of birth. Data on race and ethnicity were then combined; Asians were included with Whites (similar distributions of all variables). Hospitals were classed as "public" for municipal hospitals and "nonpublic" for the remaining hospitals. All public hospitals were teaching hospitals, providing primary care and specialty services, largely to low-income populations. No individual measures of SES were available.

Data from the 1970 and 1980 US Census were used to define ecological measures of SES, on the basis of a ranking of the health area of residence at the time of diagnosis. Health areas are geographically contiguous areas composed of two to six census tracts; there are 365 areas, each with a mean population of 20 000 residents. Area ranks were based on a composite index of the percentage of families below the poverty level and the percentage of unemployment as has been previously described.[16] By subtracting SES rank in 1970 from SES rank in 1980, we also developed an index of SES change.

SAS programs were used to assess bivariate relationships; logistic regression models were developed to predict late- versus early-stage disease; and categorical stratified analyses were used to explore interactions between significant variables.[17,18] Independent predictors included the following characteristics of individuals: age, race/ethnicity, gender, and hospital. Area variables included SES and change in SES.

Results

Characteristics of the sample and associations of individual predictor variables and stage are summarized in Table 1. There was a significant difference in the mean age of diagnosis by ethnic group (73.7, 68.4, and 65.9 for Whites, Blacks,

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TABLE 1—Characteristics of the Colorectal Cancer Cases (n = 26 014)[a]: New York City, 1980 through 1985

Variable	Early Stage, %	Late Stage, %	% Total Sample
Gender[b]			
Male	39.3	60.7	48.7
Female	37.9	62.1	51.3
Race/ethnicity[c]			
Black	32.7	67.3	13.8
Hispanic	34.4	65.6	6.4
White	40.1	59.9	79.8
Hospital[c]			
Public	34.1	65.9	7.1
Nonpublic	38.9	61.1	92.9
Age[c,d]			
≤45 y	34.1	65.9	3.0
45–59 y	35.9	64.1	15.4
60–79 y	39.0	61.0	60.9
≥80 y	40.1	59.9	20.7
Socioeconomic status (SES) rank,[c,e] mean (±SD)	225.53 (±72.9)	216.63 (±75.0)	220.40 (±74.54)
Change in SES rank,[c,e] mean (±SD)	−3.19 (±59.65)	−5.58 (±60.74)	−4.70 (±60.35)
Total[f]	39.7	61.3	100

[a]Total numbers of cases with known stage; the number with complete data for individual variables varies.
[b]Difference for late vs early stage significant at $P = .03$.
[c]Difference for late vs early stage significant at $P < .001$.
[d]The mean age of sample was 71.4 (±11.60) years.
[e]These variables were added to the New York State Tumor Registry data set with the use of values for the health area in which the case lived. The 365 residential health areas are ranked from lowest (1) to highest (365) SES.
[f]The percentage of nonlocal stage colorectal cancers reported to SEER is 65%.[7]

TABLE 2—Variable Predicting Late-Stage Colorectal Cancer in 26 014 New York City Residents

Variable	OR[a] (95% CI)
Age, 5-y intervals	0.97 (0.96, 0.99)
Gender	
Male	0.94 (0.88, 0.99)
Female[b]	1.00
Race/ethnicity	
Black	1.24 (1.13, 1.36)
Hispanic	1.09 (0.96, 1.23)
White[b]	1.00
Hospital type	
Public	1.08 (0.96, 1.21)
Nonpublic[b]	1.00
Neighborhood SES for each rank increase of 2 SDs	0.85 (0.80, 0.91)
SES change for each rank increase of 2 SDs	0.96 (0.90, 1.01)
Intercept	.6950

Note. OR = odds ratio; CI = confidence interval; SES = socioeconomic status.
[a]Odds ratios for having late stage; each variable is adjusted for the remaining variables in a logistic regression model.
[b]Referent category.

and Hispanics, respectively). In addition, unknown stage (9.9% of all cases) was significantly associated with age, sex, and hospital; race was not related (data not shown).

All but one of the effects observed in the bivariate analyses (SES change) remained statistically significant when we controlled for the effects of the individual and area-level variables (Table 2). For instance, individuals living in the lowest SES areas were 45% more likely to be diagnosed at late stage than persons living in the highest SES area, independent of other factors.

Several important interactions emerged when the results were stratified by levels of each of the significant predictors. The key finding was that for all age, race, gender, and source-of-care groups, individuals living in areas with the lowest tercile of SES were significantly more likely to have their cancers diagnosed at late stage than individuals living in higher SES neighborhoods (64.0% vs 60.6 vs 57.1%, $P < .0001$). Among the persons living in the poorest areas, Blacks continued to have significantly higher rates of late-stage disease (68.0%); Hispanics had intermediate rates (67.1%), and Whites, the lowest (63.1%) ($P < .0001$). The multivariate findings for public hospitals were related to the stratified result that the poorest individuals were most likely to be cared for in public hospitals (52.7% for public hospitals vs 32.0% for nonpublic) ($P < .03$). In terms of gender, for men and women, Blacks were again more likely to have late-stage cancer, followed by Hispanics, with the lowest rates in Whites. Women seen in public hospitals and nonelderly women in all settings were significantly more likely to have late-stage cancer.

Discussion

This study confirms previous findings for other cancers on relationships between sociodemographic factors and stage.[1–15,19–22] Our results also suggest that the SES of an individual's area of residence influences the risk of having advanced-stage disease, once cancer has been diagnosed. Further, our findings suggest that poverty is the key pathway though which other sociodemographic factors influence the likelihood of having late-stage disease at the time of cancer diagnosis.

The mechanism by which poverty exerts its influence on cancer outcomes has not been clearly elaborated.[23] For several cancer sites, the higher incidence rates observed in certain racial groups appears to be mediated through socioeconomic status.[19,24,25] Once an individual has developed colorectal cancer, poverty may influence the chance of having that cancer diagnosed at late stages in a variety of manners. It is possible that socioeconomic disadvantage results in diminished access to early detection services or in delayed diagnostic evaluation after an abnormal screening test.[26] Attitudes related to the culture of poverty may also make individuals less likely to utilize screening or to seek care for symptoms.[26–28] Finally, poverty may be a marker for biological factors that increase the risk that a cancer will go undetected until late stages of disease.

In terms of the influence of other sociodemographic characteristics, the age-stage relationship noted probably reflects differences in practice patterns, with elderly individuals being more likely to

have rectal examinations, either for screening or for symptoms, than younger individuals.[29] The majority of the age effect was accounted for by higher rates of late stage in women less than 65 years of age. It is possible that younger women, while more likely to have gynecological examinations than older women, are less likely to receive a rectal examination and stool occult blood testing included with the pelvic examination or other health services.

While all racial/ethnic groups were more likely to be diagnosed at late stages if they lived in the lowest SES areas, race/ethnicity was also an important independent predictor of outcome. Blacks remained at higher risk of having their cancer diagnosed at late stages, independent of area SES, while the effect of Hispanic ethnicity was reduced after SES was controlled for. It is possible that Blacks have experiences with the health care system that differ from those of non-Blacks and that negatively impact on cancer outcomes beyond the influence of SES.[30,31] Alternatively, area SES may not fully capture all of the SES variability associated with race and ethnicity at the individual level.

An individual's "social context" may also influence cancer outcomes.[21,32–34] For example, researchers have noted that diverse health conditions are related to neighborhood poverty, unemployment, and/or housing quality.[21,34–36] Moreover, *change* over time in an area's economic indicators has been related to health outcomes.[35,37]

There are several caveats that should be considered in evaluating our conclusions, including benefits of stage shifts, missing stage data, stage categorization, ethnicity definition, choice of SES measures, and the variables available for analysis. An assumption underlying our analysis is that downstaging disease through screening will confer a mortality advantage. On the basis of recent evidence of screening efficacy,[38–40] the revised US Preventive Services Task Force recommendations include colorectal screening.[41] The probability of being unstaged is associated with advancing age,[42–44] and since age was inversely related to late-stage disease, missing data may have overestimated the age effect. Missing stage was also related to hospital and gender; to the extent that these represent advanced-stage disease, the true effects of these variables are underestimated.

Using a dichotomous outcome measure, we may have not have been able to detect differences between more clinically refined stages. Our measure of Hispanic ethnicity relied heavily on the country of birth, resulting in an overrepresentation of foreign-born Hispanics (90% of the 50% of Hispanics with nonmissing ethnicity were non–US born). Thus, the effects of Hispanic ethnicity may have been underestimated by misclassification of US-born Hispanics as White non-Hispanics.

The selection of our area SES index was guided by prior research on social area analysis.[33,36] The index is well defined, uses readily available census data, and predicts differences in health outcomes.[16] Other variables not included in this study, such as patient attitudes to screening, diet, or having a regular source of care, may also be important determinants of the risk that a cancer will go undetected until late stages of disease.

Future research combining area and individual data will be important to fully delineate ameliorative pathways by which such factors as SES, race, and ethnicity contribute to poor cancer outcomes. Until then, all populations would benefit from the systematic use of screening. Screening targeted to socioeconomically disadvantaged groups may also be of value in reducing colorectal cancer morbidity and mortality. □

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